Visiting Scholar Program

March 2007

Environmental Valuation and Decision Making for Water Project Investment and Operations:
Lessons from the FERC Experience

2007-VSP-01

US Army Corps of Engineers®

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Visiting Scholar Program

Throughout its history, the Institute for Water Resources (IWR) has invited preeminent water resources academicians and practitioners to take up residence at the Institute to foster scholarly exchange. At any given time, IWR frequently has faculty from universities spending time in residence at the Institute. Both IWR and the Corps benefit from such faculty engaging in ongoing water resources studies and research on a reimbursable basis. Visiting scholars are expected to help infuse new energy and ideas to the IWR program, while the practical work environment at IWR and/or the Hydrologic Engineering Center (HEC) provides a stimulating context for mutual exploration of potential advances in hydrologic engineering and planning analysis. Such experiences have proven to be intellectually invigorating for both the Institute staff and the visitors themselves.

American Association for the Advancement of Science Science and Technology Policy Fellows Program

Through the American Association for the Advancement of Science (AAAS) Science and Technology Policy Fellows Program, IWR sponsors post-doctoral and senior fellows to work on water resource policy issues such as analyzing the linkages between water resources development and water resources problems (e.g. drought, floods) and the economies of developing nations. Individuals with a systems engineering, economics, public participation or water resources background are especially encouraged to apply. This highly selective fellowship program gives scientists and engineers a real-world introduction to how science interacts with policy in Washington.

Leo R. Beard Visiting Scholar Program

For many years, the Hydrologic Engineering Center (HEC) has invited prominent hydrologic and hydraulic professionals to take up residence at HEC in Davis, CA to foster scholarly exchange. Faculty from a number of universities have spent some of their sabbatical with HEC and on occasion HEC has also had prominent engineers from other agencies join the Center in the same capacity. The experience and the exchange of ideas that these scholars bring to HEC have proven to be intellectually satisfying and productive for both HEC staff and the visitors themselves. Such scholars in residence are known as "Leo R. Beard Visiting Scholars."

Maass-White Visiting Scholar Fellowship

The Maass-White Visiting Scholar Fellowship is designed to ensure that today's water resources challenges benefit from innovative thinking of the nation's top academics, and to promote a deeper understanding of real-world water resource problems by those in academia. The fellowship honors the late Arthur Maass and Gilbert F. White–two scholars who had a revolutionary impact on the practice of water resources planning and management.

National Research Council Research Associateship Program

Through the National Research Council (NRC) Research Associateship Program, IWR sponsors postdoctoral and senior research awards to conduct relevant research for one to two years at one of IWR's locations. Fellowships are given for the purpose of conducting research (chosen by the doctoral level scientists and engineers) to apply their special knowledge and research talents to areas that are of interest to them and to the host laboratories and centers.

UCOWR Water Resources Fellowship

The Universities Council on Water Resources (UCOWR) and IWR developed a visiting scholar program in 2003. The program invites academicians to the Institute to focus on emerging water resource issues of relevance to the civil works mission. While on sabbatical these scholars are expected to perform applied, policy-relevant research to extend the Corps of Engineers knowledge of and thinking about emerging water resources needs and issues. UCOWR Fellows, chosen via a UCOWR/Corps panel, are university professors who have substantial applied experience in water resources planning and management, as well as strong teaching credentials.

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Foreword

Proponents of monetary valuation of environmental services often argue that unless monetization of environmental services is required social preferences for environmental improvements will be ignored in water resources decision making. Leonard Shabman critically evaluated this argument in a May 2002 seminar at the Institute for Water Resources. Following the seminar IWR requested a written elaboration on the talk's principal focus – the limited role of environmental valuation in the Federal Energy Regulatory Commission (FERC) dam relicensing decision processes.

The interest in the FERC process was especially strong because FERC was addressing the same kind of issues that were increasingly facing the Corps – reviewing the viability and/or operational practices of water control projects that were built years ago, before the new emphasis on river restoration. Shortly thereafter the FERC instituted a new set of license review and renewal decision processes. Also, the Corps itself was still developing new approaches to meshing the use of monetized and non-monetized measures of value for its own.

Now, three years later, a review of the FERC experience allows firm conclusions to be drawn about the kinds of analytical information most used in FERC relicensing decision making. This paper reports on a systematic examination of the role and contribution of economic analysis, including environmental valuation, in FERC decision making. Monetary valuation of habitat changes, and ecological services in general, plays a minor role in hydropower relicensing decisions. Instead, highly structured collaborative stakeholder processes are used in place of valuation. This FERC approach provides useful insights for the Corps as it seeks to advance its environmental restoration mission in the context of its new emphasis on collaborative planning.

Introduction

Water project developments and their operations alter river hydrology, near shore and river bottom environments and coastal processes. Such alterations have been made to secure benefits such as flood risk reduction, marine and waterborne transportation, water supply and hydroelectric power generation. How should social preferences for expanding and maintaining the flow of these traditional water project benefits be weighed against emerging social preferences for watershed restoration (for example, mimicking historical patterns and timing of river flows and coastal processes)? Is this a question suited to the calculation of monetary benefits and costs, or is some other means necessary to assure that competing social preferences for different watershed conditions and uses are properly considered?

This question currently confronts the Corps planning and decision making process as it seeks to accommodate its well developed planning and evaluation procedures to a new decision environment. Some (NRC, 2004, Analytical Methods) have argued that the Corps should aggressively move to represent the full range of effects of new projects, project modifications and project operations (including effects on environmental services) in monetary terms. [1] There are, they point out, many tools that have been developed for the monetization of benefits and costs and the National Economic Development (NED) analysis should utilize these tools. Indeed, environmental valuation is an extensive research program within economics, and these researchers often argue that techniques they have developed are a preferred way to represent society's environmental service preferences in decision making.

However, others question whether monetization of all environmental services has decision making value for the Corps program (NRC, 2004, Opportunity), and the Corps itself has not included monetary benefits of all environmental services as part of the benefit cost (NED) calculation. Given increased recognition of how Corps projects and operations affect environmental services, the question facing the Corps is more than what techniques can be applied to monetize the environmental effects of their projects; it is rather which effects of their projects to monetize and how to use monetized effects for decision support within the NED (benefit cost analysis) framework?

The Corps is not alone among the federal agencies in asking such questions. Under the Federal Power Act (FPA), the Federal Energy Regulatory Commission (FERC) has decision making responsibilities governing the operations of nonfederal water projects and faces questions similar to those now faced by the Corps. In 1920, Congress created FERC as an independent commission with broad authority to decide whether nonfederal hydropower dams should be constructed and the conditions under which the dam should operate (Spence 1999). Under this authority FERC can issue dam operating licenses for up to 50 years and reissues licenses when the original license expires, called relicensing. Currently FERC licensees 1,600 hydropower facilities at over 2,000 dams (Smith 1998).

[1] We will define what we mean by environmental benefits below, but note here that many traditional benefits such as flood risk reduction would continue to be represented in money terms.

Congress did not explicitly instruct FERC to approve and promote hydropower, although this was clearly an important rationale for passage of FPA (Costenbader 1998). From the beginning, Congress instructed the FERC to balance competing uses and select those "best adapted to a comprehensive scheme of improvement and utilization for the purposes of navigation, of water-power development, and of other beneficial uses" (41 Stat. 1063, 1068 (1920)). Congress occasionally amended this passage to provide more direction to FERC as to what are these other "beneficial" uses (Sensiba 1999). In 1935 Congresses added "recreational purposes" to the list (49 Stat. 803 (1935)). The last major amendment occurred in 1986 under the Electric Consumers Protection Act which instructed FERC to give "equal consideration" to mitigation, and enhancement of fish and wildlife, irrigation, flood control, water supply, and recreational purposes (Sensiba 1999). Thus, FERC has legislative mandate to consider and evaluate the trade-offs between low cost power and changes in recreational and environmental services.

The Corps makes recommendations to the administration and the Congress on water resource project investments and operational regimes. The Corps also makes regulatory decisions in the 404 processes issuing permits for private or public entities to undertake actions in waters of the U.S. In both cases the Corps, like FERC, must consider effects and tradeoffs among consumptive market oriented uses of water resources (hydropower generation, irrigation, water supply) with impacts and changes in the ecological services. While there are differences in procedural and rule making criteria between the Corps and FERC decision-making when considering these tradeoffs, the challenges confronting decision participants are similar.

For instance, the Corps explicitly calculates the net benefits of a particular project. In hydropower relicensing, FERC reports no such estimate. Yet, the types of analysis produced and the logic that a decision should be based on a "net benefits" logic is the same. The FERC seeks to identify incremental changes in the level of aquatic services and compares these changes against incremental costs. Like the Corps, FERC has not chosen to monetize all environmental effects and instead presents some of these effects to the commissioners as physical metrics such as habitat indices, descriptions of flow regimes and wetlands acres.

In the Corps 404 permitting decisions, the permit applicant, like the FERC license applicant, seeks permission to use waters of the US for private uses. The decision criteria used in the 404 and FERC applicant review processes are different. The 404 decision criteria require the applicant to select the least environmentally damaging practicable alternative (LEPDA). While this criterion does not apply the balancing test that is the hallmark of the FERC process, the 404 permitting process does require Corps staff to identify multiple changes in ecological services and interpret "least damaging" and "practicable".[2] Here too a balancing among effects represented by both monetary and non-monetary metrics is applied.

In the past few decades, FERC has come under increasing criticism for failing to give adequate emphasis or "weight" on environmental services when the commissioners make the tradeoffs that establish licensing conditions (Stephenson 2000). As one way to make better informed trade-offs, some argued that FERC commissioners could use calculated money values

[2] See Shabman and Cox, 2004, for a discussion of the LEPDA and how it differs from the traditional planning model.

for all ecosystem services to compare with hydropower values. Without monetization FERC is said to be unable to make "apples and oranges" comparisons (Loomis and Feldman 1995, 97) and the implication is that environmental services will be overlooked without monetization (Moore et al. 2001). But FERC has resisted this suggestion. Instead of expanding the scope and kind of calculations conducted, FERC has instituted new licensing processes for giving due consideration to environmental effects.

The question posed here is whether environmental valuation in money terms is necessary or useful information for tradeoffs or are there other ways to approach this decision making problem? FERC has chosen an alternative path to monetization. What can be learned from the FERC experience that is relevant to the Corps planning and decision making process that faces a similar problem? We will address these questions in this paper. We set the stage with a review of benefit cost analysis and the larger debate over full monetization of societal preferences for the environmental conditions created by water projects and their operations. Then we report on the use of environmental valuation and other analyses in FERC dam relicensing decisions. We then interpret the changes in the FERC relicensing process in the light over the debate over environmental valuation. We conclude by drawing implications for evaluation and decision making for environmental restoration activities in the Corps.

Environmental Valuation

The aquatic environment (estuaries, lakes, streams and rivers and associated land resources such as wetlands, riparian zones and coastlines) can be viewed as natural capital that yields a flow of services valued by people. We refer here to this natural capital as a "watershed". This natural capital can be characterized by its structure, functioning and services provided to people. Structure refers to the physical characteristics of the water resources and related landscape as these features are altered by human activity; examples include the hydrologic regime of a river, the location and kind of wetlands in the watershed and the land cover. Functioning refers to the processes that are present given the structure, such as nutrient cycling, carbon cycling, and aerobic and anaerobic processes. For example, the hydrologic and geomorphic processes of rivers and coastlines are altered by the presence of water control projects. The current interest in "naturalization" (NRC, 2004b) of rivers and the adjacent lands represents a focus on structure and function. Structure and function, as altered and managed by human activity, give rise to services that may be valued by people. That is, the services that flow from watersheds are a product of the original natural system and the investment made to alter that natural system over time and the management of that investment in each point in time. The watershed structure and function, and hence services, are a consequences of social investment, and land and water use choices.

Watershed services include direct inputs to economic production and direct consumptive use. These services that have a direct use by people =were the focus of the traditional water development programs: water borne commerce, power generation (hydroelectric and thermal cooling water), enhanced land productivity for food and fiber production by drainage and flood hazard reduction, as well as water for irrigation, industrial

production and municipal use. Commercial harvest of fish and wildlife and recreational uses have always been recognized as services valued by people.

Other services of watersheds that have been recognized in recent years are often viewed as "intangibles". The aesthetic beauty that is often ascribed to natural landscapes has been seen as a source of inspiration and solace for people. The waste assimilation services may be used by intention, but often they are simply the inevitable result of the economic activity in the watershed. When use of waste assimilation services results in a reduced level of the other environmental services, pollution is said to exist. Life support service are the most difficult to define, but most closely represent the new emphasis in environmental management. This service may be diminished by use of the environment for waste assimilation, but may also be diminished by any alteration to secure production inputs and for direct uses. For example, the alteration of hydrologic and geomorphic processes may have adverse affects of the food web that supports recreational species.

Monetization of direct uses (services) for benefit cost analysis has been common practice for decades, although monetization of recreational benefits has not been as common a practice. Monetization of all services for benefit cost analysis, including intangibles, has not been common practice.

Monetization of Preferences for Watershed Structure, Function and Services

The desirability of management activities in watersheds could be evaluated by how they affect the levels of each of the services, with versus with out the management activity. A common premise of assessing the "desirability" of these activities is to assess the strength and importance of social (human) preferences for different levels of these services. Preferences for these services are said to arise from the possibility of their direct use, from a desire to preserve the option for possible future use and the assuring the existence of such services for altruistic (intra and intergenerational) purpose or simply as an expression of a moral position.

Advocates for environmental valuation argue that willingness to pay is an explicit way to quantify and compare preferences for these different services. Monetary valuation, for any service, is a way to represent the strength of peoples' preferences (what they are willing to pay) for a particular service from natural capital.[3] The premise of the willingness to pay approach is that individual's know their preferences for goods and services (states of the world) before being confronted with a choice, that people are willing to incur costs (prices paid for the good or service) to satisfy those preferences and whatever an individual chooses is in the interests of that

[3] In application preferences of individuals as reflected in willingness to pay are aggregated by income; that is those with higher income have greater ability to pay and so their preferences are more heavily weighed. Also, the maximum net benefits criterion is a strict utilitarian calculation where measured benefits only need to exceed measured costs, and there is no expectation that those who gain from a project need to compensate those who are worse off, or are in any way expected to pay for benefits received. IN addition, the assignment of initial property rights might suggest that value is best represented by willingness to sell and not willingness to pay. These often are criticisms of the use of willingness to pay as a benefit measure, but these criticisms are not explored further in this report.

individual (Randall and Peterson 1984). The logic of the argument is straightforward. In market exchange money income is sacrificed (a price is paid) in order to secure some good or service. By arguing that preferences guide market choices, analysts conclude that the money value of a good or service is at least equal to the amount of income a person spends to obtain the service. Thus market prices, or as noted below simulated market prices, are the raw data for preference measurement. The price paid is the willingness to pay "at the margin"; that is, prices are interpreted as the value to people of one unit more or less of a good or service. Total value is not the same as marginal value. Instead total value is the money income you would be willing to forgo, but do not have pay, to receive the good or service.

Advocates of environmental valuation also argue that to fully represent social preferences in the environmental decision processes, monetization should apply for **all** services. An explicit assertion is often made that people's preferences for the existence of an additional mile of free flowing rivers or generating additional units of hydroelectric power should be compared in like metrics. If Corps planning, or the FERC review process, fully monetizes all outputs of any alternative, then social preferences for the alternative are empirically measured within the NED (net benefits) calculation. The benefit cost analyst measures willingness to pay for changes in each of these services with versus without the alternative being considered. These results are added and the financial costs for implementing the alternative are subtracted from the result. The alternative with the greatest net benefit is offered as the socially preferred project.

Calculating willingness to pay for what in the past were viewed as intangibles has become an interesting research puzzle and analytical challenge for some economists. Environmental valuation techniques are applied to estimate willingness to pay for certain uses of the service (use value) as well as nonuse values. There may also be willingness to pay for the preservation of an option to use the service if the user believes the service might be lost and the loss is irreversible and there are no adequate substitutes (option value). There may be willingness to pay for the continued existence of the service, even if there is no expectation of any current or future use (existence value). Existence value may be attributed to an altruistic or bequest motivation and is expressed when a person believes the service might be lost and the loss is irreversible and there are no adequate substitutes.

The research program on environmental valuation has yielded an extensive literature on measurement techniques, including such matters as questionnaire design, sampling and statistical approaches for data assessment. Today, it is possible to provide calculations of any environmental value, but any particular calculation may be accompanied by professional debates over the technical validity of the calculations. The calculations are of three general types.

Revealed choice techniques derive environmental value by interpreting or decomposing market prices of market goods or services that are related to some measure of the environment. Land prices near polluted and clean bodies of water are compared to derive the value of cleaner water to land market traders. The time and financial costs people incur to travel to a recreation site are probed for evidence about the value of that site. Recent valuation studies have used purchases of insurance, substitute goods (ex. bottled water), subscriptions to magazines and memberships in environmental organizations to estimate environmental values. Other studies

have analyzed voting behavior and wage differentials among occupations to secure value estimates. All of these approaches interpret choices actually made to derive value estimates.[4]

Hypothetical choice techniques use personal surveys to isolate the choices that people would make if they had to pay for alternative states of nature. The survey method, generally termed the contingent valuation method (CVM or stated preference), is analogous to public opinion polling. Individuals are asked in personal interviews, a telephone inquiry or in a written survey to imagine a possible choice that they might have to make (for example to vote to raise their taxes to pay for a wastewater plant that would improve water quality). A carefully designed and administered survey instrument is one that constructs a choice situation that would be present in a market. At its simplest, the respondent has information about the service to be provided and price they are being asked to pay; the respondent can then respond that they would or would not make the choice to pay for the service. A more current variant of the survey approach - contingent ranking - forces respondents to make more explicit choices among competing bundles of serves for a given budget. These choices can be interpreted as willingness to pay, but may simply be reported as ranked preferences. Among those economists who may agree on the need to monetize environmental services, the technical issues surrounding survey approaches continue to be debated (Carson, Flores and Meade, 2004).[5]

Alternative cost measures of willingness to pay are the third general approach to benefit estimates and one widely used in government reports. This general approach assumes that the cost of the most likely alternative being proposed, or avoided costs if the project is implemented, can be used as estimates of willingness to pay. Examples of avoided cost estimates of willingness to pay include avoided flood damages and

expenditures on one activity to avoid expenditure on another for water supply, power and navigation benefits. Alternative cost approaches have a long history in benefit cost analysis but may only be acceptable as a measure of willingness to pay under certain circumstances and assumptions. A recent NRC report (NRC, 2005) urged great caution in the use of this calculation as a willingness to pay measure, “The replacement cost method and estimate of the cost of treatment are not valid approaches to determining benefits and should not be employed to value aquatic ecosystem services.”

As an approach to reflecting social preferences, such techniques can be used to measure what people may be willing to pay for changes in the watershed structure/ function as well as services. At times, environmental valuation techniques can be used to estimate willingness to pay for watershed functions, with only limited recognition or consideration of the services to be

[4] For a summary see: Freeman, 2004.

[5] In one sense environmental valuation by survey is akin to public opinion polling, wherein respondents to surveys are given certain information and with limited time available for learning or dialogue with others are asked to make a choice that is then interpreted as their preference. To argue that environmental valuation is “dollar democracy”: is to argue for democracy as a public opinion poll. If a measure of existing public opinion is desired information for supporting a decision making process, other public opinion polling approaches and calculations also might be considered. For example a survey that asked about levels of agreement with statements about options and tradeoffs may be essentially the same as this “valuation” effort. It is the case, however, that far more care is taken in environmental valuation work, at far greater expense, in questionnaire design, sample selection and more.

derived. Willingness to pay may be for "more natural" watershed conditions and metrics of naturalization may be the way outputs of watershed management activities are represented. As a simple example, a metric for an environmental outcome may be more or less wetlands in the landscape. In a more complex setting the metric may be for the partial restoration of historic patterns of river flows for restoring multi-species life support (Postel and Richter, 2003).

Environmental Valuation and the Corps

As a basis for decision-making, the Corps has long accepted that preferences and willingness to pay have been an integral part of Corps analysis. In the language of the P&G, NED analysis, whether for valuing different levels of such effects as flood risk, bulk commodity transportation, hydroelectric power, a day of successful fishing, or the existence of an endangered species, is about valuing people's preferences for more (a benefit) or less (an opportunity cost) of these and other services. The different effects (both positive and negative) are measured, added together and compared to costs. Note that this means that benefit-cost (NED) analysis is a preference aggregation procedure. The basic benefit evaluation principle in the National Economic Development Account (NED) in the P&G reflects this logic:

> "The general measurement standard of the value of goods and services is defined as the willingness of users to pay for each increment of specific goods and services from a plan. Such a value would be obtained if the seller of the output were able to apply a variable unit price apply a variable unit price and charge each user an individual price to capture the full value of the output to the user."

Of course not all the impacts on services have been incorporated into project and program evaluations and if recognized not all the effects have been monetized so they can be readily compared with each other through a benefit cost calculation. Instead many of the effects have been considered intangibles to be represented in other ways and are expected to stand outside the benefit cost monetary calculation. In this case decision makers are expected to consider both monetized and measured but not monetized effects in making a decision. *In the remainder of this report we refer to monetization of the services that have not traditionally been monetized as "environmental valuation" (EV).*

The Role of Environmental Valuation in Policy

Advocates of environmental valuation still will argue that if all service changes are monetized, that a resulting benefit-cost decision rule should not be the sole basis for making a policy decision (NRC, 2004a; Arrow et al. 1996). Thus EV advocates acknowledge, like the P&G, that the final decision will rest with decision-makers considering a variety of relevant issues related to the policy choice. If EV is used as a decision-aid, the question is to what extent does monetization of preferences for environmental valuation assist decision participants to evaluate and decide trade-offs between environmental services. The question in this report is not over whether such calculations should be done or how to better do such calculations. Instead we ask, to what extent are environmental valuation studies used to monetize environmental services (if so what kind of services) and if conducted, how are such studies used to aid decision-making.

By asking about the "use" of analysis, we are asking about the instrumental use of environmental valuation in decision-making. Instrumental use is defined as analyses that decision participants feel is necessary to advance the decision-making process. In this role, environmental valuation might be important to evaluating a specific tradeoff or to decide a specific alternative. For instance, benefit estimates might be used to weigh public preferences for enhanced stream flow against foregone power costs to construct the net present value of different instream flow alternatives in a comprehensive NED analysis.

Another instrumental use might involve the use of environmental valuation for persuasion. For example an environmental valuation analyses might be produced to convince others to in a public decision process about the wisdom of a particular water project investment or operations alternative. Thus, the instrumental value of environmental valuation its use in effective political advocacy to justify incremental expenditures on an alternative.

On the other hand, environmental valuation analyses might not be used to help decision participants arrive at a particular decision. One possible instrumental use of environmental valuation might be labeled "legitimation". In this case, environmental valuation might be produced to help defend or explain a decision that was made based on other types of analyses. An obvious example of legitimation is the production of environmental valuation analyses after a specific decision is made. Legitimation is not superfluous. Legitimation might serve a role of providing professional credibility to a decision, but not as a way to assist in making the decision.[6]

In the next section, we investigate the FERC debate over the use of environmental valuation and examine how the FERC decisions processes seek to discover emerging environmental values and to evaluate trade-offs involving environmental services. In cases where environmental valuation is used, we explore what types of services are monetized, the circumstances of its use, and what role the analysis played in the decision process.

Environmental Valuation in FERC Hydropower Relicensing Processes

The FERC hydropower relicensing process provides an opportunity to examine the role of environmental valuation in a number of different decision making settings. In the last 20 years, the FERC licensing process has evolved from a process centered largely on staff-level analysis in support of the Commissioners decision making (called the traditional licensing process) toward more collaborative forms of decision-making (called the alternative and

[6] This use of analysis can apply to calculations other than environmental valuation. Theodore M. Porter's in his book, Trust in Numbers: The Pursuit of Objectivity in Science and Public Life, (page 8) asserts that the attraction of numbers as a guide for decision making (environmental valuation in this paper) has the instrumental value of placing a veneer of democracy over what is a necessarily partially-closed system of administrative decision making. He states, "The appeal of numbers is especially compelling to bureaucratic officials who lack the mandate of a popular election, or divine right. Arbitrariness and bias are the most usual grounds upon which such officials are criticized. A decision made by the numbers (or by explicit rules of some other sort) has at least the appearance of being fair and impersonal. Scientific objectivity thus provides an answer to a moral demand for impartiality and fairness. Quantification is a way of making decisions without seeming to decide. Objectivity lends authority to officials who have very little of their own."

integrated licensing process). FERC has also found itself involved in the center of an emerging environmental movement to remove functioning hydropower facilities. Increasing calls for dam removal have focused tremendous public attention on the agency and has forced the agency to confront issues typically considered beyond the historic scope of FERC authority. The use and role of environmental valuation is also examined in these high profile, precedent setting, dam removal cases

Background: Hydropower Licensing Decision-making

The Traditional Licensing Process

The traditional licensing process consists of two stages: a pre-application consultation phase and a post application analysis phase (Powers 2004; GAO 2001). The primary responsibility of the consultation phase rests with the applicant (dam owner) who must notify FERC of intent to file a license (GAO 2001; Powers 2004). The applicant is then required to provide interested parties, such as state and federal resource agencies and tribal governments information about the project. The license applicant is required to fund and complete "all reasonable and necessary" studies to identify the project impacts on fish and wildlife, recreation, water quality, and other resources (Powell 1997). The applicant must seek input from these involved stakeholder groups to identify these studies. An informal dispute resolution mechanism may be initiated to resolve study disagreements.

The post application process begins after the studies are complete and the applicant prepares and files an application with FERC. Unlike the consultation phase, FERC staff direct the post application process and analysis (Powers 2004). During this phase, participating stakeholders (including nongovernmental organizations who officially file for intervener status) have another opportunity to request additional studies and to provide comments and recommendations on the license application. FERC decides whether to require the applicant to conduct the requested studies. When FERC decides it has sufficient information, FERC staff then conducts its environmental analysis (EIS or EA) as required by NEPA. Based on applicant's studies, additional information provided by participating stakeholder groups, and its own analysis, FERC staff recommend a set of licensing conditions to the Commission itself.

FERC's five Commissioners then decide the license conditions in a formal license order.[7] The Federal Power Act directs FERC to adopt a license that is best adapted for "improvement and utilization of waterpower development, for the adequate protection, mitigation, and enhancement of fish and wildlife…and for other beneficial public uses, including irrigation, flood control, water supply, and recreational and other purposes." (16 U.S.C 803 (a)(1).

In practice the traditional licensing process has been described as adversarial and applicant driven (Swiger and Grant 2004). Since FERC staff is not directly involved in early negotiations (pre-filing) between the license applicant and other stakeholder groups, disputes tend to be postponed until the post application phase. Over time, federal and state agencies and

[7] Commissioners are appointed by the President with the approval of Congress.

other interveners have been more inclined to wait until post application phase to make requests to FERC for additional studies (Hill and Murphy 2003). Once the application reaches the post application phase, FERC staff assume the responsibility to mediate and decide license conditions between stakeholders with opposing recommendations.

Alternative and Integrated Licensing Process

Due the growing delays and conflict arising in the traditional licensing process, FERC instituted an optional "alternative" licensing process in 1997 (18 C.F.R. § 4.24(i) 2000). The alternative relicensing process places more emphasis on early negotiation and collaboration between the license applicant and involved stakeholders (Powers 2004; Hill and Murphy 2003; Swant 2001; Bonham 1999; LaBolle 1999; Groves and Liimatainen 1999). The alternative process facilitates this negotiation by pushing more analysis and FERC support into the pre-application phase of the process. NEPA document preparation is moved into the pre-application phase where the applicant and stakeholders, not FERC, are largely responsible for preparing a NEPA document and a license application. Unlike the traditional process, FERC staff become actively engaged in facilitating the consultation process (Hill and Murphy 2003).

By the time the license is filed, FERC staff have a draft NEPA document and license application jointly submitted by the license applicant, resource agencies, Tribes, and NGOs. FERC then produces a final EIS and license recommendations. The presumption is that if all interested parties to the negotiation can agree on a mutually satisfactory license conditions and such conditions are within FERCs authority to confer, the FERC will translate these conditions into a new license. As a practical matter, the alternative process decentralizes decision making by downplaying the role of the FERC staff and commissioners in judging whether the cost imposed by a license condition is worth the benefits (Stephenson 2000).

Recently, FERC implemented another licensing process in 2003, called the Integrated Licensing Process or ILP (FERC Order No. 2002, July 2003). Conceptually, the ILP is an elaboration of the alternative process (Swiger and Grant 2004; FERC 2006). The ILP stress and supports collaboration early in the licensing process, but adds a number of schedules/timelines and dispute resolution provisions to the alternative process (for example a close ended process to settle any pre-application study disputes). In 2005 the ILP process became the default licensing process, officially replacing the traditional process. A license applicant, however, may still select to file under the less restrictive alternative process after 2005.

Precedent Setting Cases: Dam Removal

Historically, a fundamental premise of the FERC relicensing processes was that an existing hydropower facility will be issued a new license. The primary task of the licensee, stakeholders and FERC was to select mitigation alternatives (fish passage devises or minimum instream flows) for an operating hydropower facility. The idea that a dam might be removed for the purpose of river restoration (as opposed to removal for safety reasons) was never considered a licensing option (Stephenson 2000). Yet, the issue of removing operating dams for the purpose of ecosystem restoration (as opposed for safety reasons) is rapidly gaining national attention and

interest (McPhee 1999; Murr 1999; Lowry 2003; Born et al. 1998; Heinz Center 2002; Doyle, Harbor and Stanley 2003).

FERC has responded to the dam removal issue by issuing a rule in the mid-1990s that claims FERC has the authority to order the removal of a dam against the owner's wishes (FERC 1995). The hydropower industry has raised strong objections to this assertion and does not believe the Federal Power Act grants FERC such authority. The legality of FERC's dam removal authority has yet to be tested in court (FERC 1997). At the same time, FERC stresses that its dam removal authority will only be exercised in rare cases (FERC 1997). Consistent with this claim, FERC has only exercised this authority once (the Edwards Dam on the Kennebec River in Maine).

Given this context, any case where FERC seriously considers and evaluates dam removal tends to generate a tremendous amount of attention, interest, and conflict. Dam removal cases also place restoration of river ecosystems at the center of the licensing process. Given the intense interest and conflict, dam removal cases also generate substantial analytical efforts focused on the changes in environmental service flows. Such cases may provide another context in which environmental valuation studies may contribute to the licensing process. This report examines the use and role of environmental valuation studies in two high profile FERC dam removal cases - the removal of two dams on the Elwha River (Washington state) and the Edwards Dam.

Methods of Inquiry

The use and contribution of environmental valuation in these three FERC decision contexts was identified in a sequential process. First, evidence was collected to determine the type and extent to which environmental valuation studies were produced in the each of the three relicensing contexts. This included identifying the type of environmental amenity being monetized and the valuation method used.

Evidence of the type and extent of environmental valuation study production was obtained from a variety of sources. Secondary sources related to the use of technical analysis in FERC, including FERC policy documents, academic studies, and gray literature was collected. These materials often provide insights into the type of analyses being produced in FERC cases, including environmental valuation studies. In addition, case study analyses were conducted as necessary. In the licensing of an individual hydropower project, FERC publishes the environmental impact statement (EIS) or environmental assessment (EA) and a license order. The EIS/EAs contain a description of the project, the consequences of the project and a summary of the types of analyses conducted. Thus, these documents provide a written catalogue of the type of analyses produced in each case.

However, the production of an environmental valuation study in a specific relicensing case does not identify the role and contribution the analyses played in decision making. If environmental valuation studies are being produced, the second step is to identify how the environmental valuation studies are used in the decision process. More specifically are such valuation estimates used as part of a net benefits calculation to identify socially preferred

tradeoffs, as a means for persuading others about the wisdom of a particular licensing alternative or to defend or explain a licensing decision that was made based on other types of analyses (legitimation).

In cases where there is sufficient production of environmental valuation analysis, the second stage of the analyses attempts to identify the role environmental valuation plays in a particular case or decision context. The specific contribution of environmental valuation was established using a pattern modeling approach. Pattern modeling is a structured approach to understanding complex decision-making processes (Wilber and Harrison, 1978). The product of pattern modeling is, unapologetically, a narrative (a story). The data come from diverse sources including published literature, administrative records, personal observation, interviews, and analyses of quantitative data. Of special note is that pattern modeling puts a premium on incorporating details of the legal, social, and organizational setting and minimizes the use of simplified assumptions about behavioral motivations of organizations and individuals. Through this array of data, a pattern model seeks to understand the role of analyses within the complexity of a specific relicensing case or set of cases. Such an approach helps construct understanding and insights into the following types of questions: What analytical challenges were decision participants confronted with? Why was the study produced? What did the decision participants hope to gain from the results of the environmental valuation study? When was the environmental valuation produced relative to other analyses and relative to the final decision? In attempting to construct plausible and verifiable answers to such questions, reasonable conclusions can be drawn that relate to the role and contribution environmental valuation analyses played to the overall decision process.

Valuation in the Traditional FERC Relicensing Process

Within the traditional FERC licensing process, environmental valuation estimates are rarely produced and play essentially no role in deciding licensing conditions. This conclusion is both well established in the academic literature (Stephenson and Shabman 2001; Moore et al. 2001), white papers/gray literature (Marcus 1999; Industrial Economics 1998) and by FERC guidance documents (Fargo 1991).

In general, FERC staff typically only monetize changes in the level marketed commodities. The analytical baseline for the licensing process is the operations and resulting levels of services under the existing license. FERC then calculates the financial costs to the license applicant of alternatives to the existing license. The costs are the capital and annual operating and maintenance costs of operating the facility. Costs also include foregone power benefits (typically measured as increase in cost associated with replacing lost hydropower production with the next best available alternative).[8]

In most relicensing cases, the majority of analytical attention is directed toward mitigating environmental harms from operating the facility by managing downstream flow/reservoir levels, fish screen/entrainment, fish passage facilities, recreational enhancements,

[8] The value of replacement power historically was measured as a replacement cost – the estimated cost of replacing lost hydropower production with a close fossil fuel alternative. Recently, the value of lost hydropower production has increasingly been calculated using power prices in the wholesale power markets.

and environmental enhancements (riparian buffers, wetlands). The FERC staff calculates the reduction in the net financial position of the licensee (e.g. increased costs from the construction costs of a fish passage facility or reduced power revenues due to increasing minimum instream flows) for different mitigation options.

The cost to the licensee of different mitigation options is then compared to different measures of environmental change. The cost of replacement power and project modification costs are compared against typically a suite of indicators that measure the changes to the natural environment from a mitigation option. These indicators might include changes in fish populations, acres of habitat, and increased number of recreational user days. These trade-offs are sometimes explicitly analyzed as incremental knee-of-the curve type analyses. For example, such analyses might quantify the incremental gains in usable fish habitat against the sum of the financial and power replacement costs for securing different minimum in stream flows (Fargo 1991). More common are qualitative evaluations of the extent of the environmental enhancements compared to the estimated costs.

Some indicators might be expressed in monetary terms. Environmental outcomes may include replacement cost analysis, such as replacing the juvenile fish lost to entrainment through hatchery production. Also, regional economic impact studies may be conducted (Marcus 1999). Regional impact analysis results may be reported as dollar changes in wages or income. Neither of these dollar calculations are measures of willingness to pay. Research on FERC decision-making consistently reports an almost complete absence of willingness to pay estimates for establishing environmental mitigation measures (Moore et al 2001; Loomis and Feldman 1995). Moore et al (2001, 424) state:

> One result is clear from examination of the record: FERC does not explicitly weigh the social benefits and costs of relicensing decisions. It regularly considers only private hydropower revenues and costs in its decisions. The opportunity costs of hydropower operations – in terms of the benefits of whitewater recreation and sport fishing – are rarely quantified in the sample of licenses studied here.

Thus, the decision to require a mitigation alternative, and the scale of that alternative, is made by FERC commissioners (based on staff analyses and recommendations) based on their judgment of whether the mitigation option is "worth" the financial cost to the licensee. The FERC commissioners tend to approve environmental mitigation options with relatively low marginal financial costs and reject enhancements when the marginal gains begin diminishing rapidly or are extremely uncertain. The majority of analytical resources in a traditional FERC analysis are devoted to identifying the physical and biological response (engineering and life science analyses) of different licensing alternatives.

Valuation in the Alternative Licensing Process

This traditional relicensing process came under intense scrutiny and criticism for failing to place enough weight on enhancement to environmental services (mitigation of past effects) when making licensing decisions (Stephenson 2000) and for being too closely aligned with the

interests of the license applicant. Federal and state resource agencies and NGOs dissatisfied with FERC became increasingly aggressive in challenging FERCs decisions and the exercise of their authority in the traditional relicensing process (Sensiba 1999). This conflict in turn increased the cost and time to process a license (Keil 2002). A U.S. Dept of Energy study indicated the relicensing process took nine months to complete prior to 1986, three years to complete in 1987, and over four to complete between 1994-96 (Hunt and Hunt 1997).

Some observers proposed that evaluations of license alternatives include environmental valuation (monetization of all effects) (Marcus 1997; Moore et al. 2001; Loomis and Feldman 1995). The argument was that if FERC staff did a better job at monetizing the benefits of all the environmental services, consideration of such matters as more natural river flows and fish habitat enhancements would be more likely to be given more weight by the FERC commissioners in their decision making.

FERC's response, however, was not to revise its analytical procedures. Rather, FERC created the alternative and integrated licensing processes that emphasized collaboration and negotiation among stakeholders as a way to account for environmental concerns. FERC placed responsibility on the licensee, state and federal resource agencies, and nongovernmental environmental interveners to negotiate and weigh the merits of various licensing alternatives. These parties also assume primary responsibility for determining what types of analyses will be conducted in the course of the negotiation. Agreement essentially assured endorsement by the commissioners.

Given the new emphasis on stakeholder negotiation, the question then becomes, "Are participants in the new licensing processes using environmental valuation studies as an aid to their deliberations?" Nothing in the new licensing rules precludes such production and use of EV analyses.

To examine whether environmental valuation was used in the new licensing process, a list of all cases settled under the alternative licensing process through 2003 was obtained from FERC.[9] The list contains 18 cases, representing 29 different individual hydropower projects (or test cases prior to formal adoption of the rules) (see Table 2).[10] The EIS/EA and license order for each case were obtained from FERC records and searched for evidence of the production or use of environmental valuation studies or estimates.

[9] The integrated licensing process is too new to have a case history.

[10] Some cases involved more than one hydropower development. In these cases, FERC processed these hydropower developments on the same watershed and operated by the same owner as a group.

Table 2: Cases Settled Under FERC's Alternative Licensing Process 1996-2003

FERC Docket Number	Project Name	Location	Licensing Date
P-1951	Sinclair	GA	3/1996
P-11243	Power Creek	AK	12/1997
P-11393	Mahoney Lake	AK	1/1998
P-2375 and 8277*	Riley-Jay-Livermore and Otis	ME	9/1998
P-1218	Flint River	GA	12/1998
P-2058	Clark Fork	MT/ID	2/2000
P-2609	Curtis/Palmer	NY	4/2000
P-420	Ketchikan Lakes	AK	8/2000
P-1980, 1759, 11830, 11831, 2072, 2073, 2074, 2131, 2471*	Big Quinnesec, Way, Peavy, Twin, Lower Paint, Michigamme Falls, Hemlock Falls, Kingsford, Sturgeon	WI/MI	1/2001
P-2035	Gross	CO	3/2001
P-2901 and 2902*	Holcomb Rock and Big Island	VA	10/2001
P-2016	Cowlitz	WA	3/2002
P-2077	15 Mile Falls	NH/VT	4/2002
P-11834	Upper/Middle Dams	ME	12/2002
P-271	Carpenter-Remmel	AR	12/2002
P-346	Blanchard	MN	5/2003
P-2364 and P-2365*	Abenaki and Anson	ME	7/2003
P-2000	St. Lawrence-FDR	NY	10/2003

* Projects evaluated and licensed jointly.

Of the 18 cases settled under the alternative licensing rules, not one EIS, EA, or licensing order reported an environmental valuation study or estimate. While the alternative process differs from the tradition process administratively, the type of analyses produced under each tends to be quite similar. Every alternative licensing case reported in Table 2 contained financial cost analysis of foregone power and many contained cost estimates of various recreational enhancements or fish passage alternatives. Participants in the collaborative negotiation processes devoted the majority of analytical resources to estimating the physical and behavioral outcomes of different mitigation alternatives in relation to the costs.

Table 3 presents a summary of the types of analyses used to quantify and evaluate the changes in environmental services for the 18 cases. Incremental stream flow and fish response studies were the most common type of analyses used by participants in these negotiations (although these studies differed dramatically in levels of sophistication). Half of all the cases reported estimates of current recreational use or predicted changes in recreational use from different licensing alternatives. These behavioral changes were not monetized, but reported as user days or quality of recreational experiences. The quantity of air emissions being avoided through the use of hydropower were reported in 6 cases, but this reporting appeared perfunctory

and were never mentioned in explanations or justifications for specific licensing recommendations.

Table 3: Analysis on Environmental Service Changes under FERC Alternative Licensing*

FERC Docket	Recreational User Day Data/Studies	Incremental Flow Studies/Habitat Analysis	Avoided Emissions	Entrainment/ Fish Passage Analysis	Envir. Valuation
P-1951	X	X			
P-11243					
P-11393		X	X		
P-2375 & 8277	X	X			
P-1218	X		X		
P-2058	X	X		X	
P-2609	X	X	X	X	
P-420		X			
P-11561	X	X			
P-1980 et al		X			
P-2035		X			
P-2901 & 2902		X			
P-2016		X	X		
P-2077	X		X	X	
P-11834	X	X			
P-271	X	X			
P-346				X	
P-2364 & P-2365	X	X			
P-2000	X	X	X		

*Analysis reported in EIS/EA case documents.

Valuation in Precedent Setting Case: Elwha River

The Elwha River is located in northwest Washington and a substantial portion of the watershed lies within Olympic National Park. Historically, the river produced large runs of 10 different species and races of salmon (DOI 1994). This situation changed in 1911 with the construction of Elwha Dam 4.9 miles from the river's mouth that cut off 65 miles of high-quality salmon spawning habitat up stream (James River 1988). The second hydroelectric project, Glines Canyon Dam, was built in 1926 about 8 miles upstream from Elwha Dam. For most of the relicensing process the dams were owned and operated by a private company (James River Corporation) for the purpose of supplying about 40% of the power to their pulp and paper mills.

When relicensing proceedings on the Elwha dams commenced in the mid-1980s, the idea of removing an operating hydroelectric dam for the purpose of ecosystem restoration (rather than for safety reasons), was considered a heretical idea by FERC, federal resource agencies, and most mainstream environmental groups. Yet, in seven years, the federal resource agencies, the Elwha Indian Tribe, and nongovernmental groups had pushed the dam removal alternative to center stage in the licensing process. It then took an unprecedented intervention into the hydropower relicensing proceedings by Congress in 1992 to decide to remove the dams (Public Law 102-495).

The expression of support and commitment to restoring the ecological functioning of the Elwha River to pre-dam conditions was accomplished in the face of considerable costs, technical uncertainties, and legal challenges. During the course of the decision process, a contingent valuation study was commissioned to monetize the value of removing the Elwha dams to restore the river to its natural state and to improve native salmon populations (Loomis 1996).

The literature describing that work suggests that this valuation study made an instrumental contribution to the decision to remove the dams (Loomis 1996, 1997, 1998, 2000). Yet, while an ecosystem valuation study was conducted, it was done so only after the decision to remove the dams had been made. Thus, while an environmental valuation analysis was produced in this FERC case, the role the analyses played in the dam removal decision appears to primarily one of legitimizing a decision that had already been made.

The transformation of the Elwha dam removal case from a conventional licensing process to a precedent setting dam removal case progressed in three distinct phases: discovery, conflict, and resolution. The role and contribution of this environmental valuation study in the Elwha case has been described extensively elsewhere (Gowan, Stephenson, and Shabman 2005) and is summarized here.

At the onset of the relicensing process in the mid 1980s, many of the resource agency staff were interested in restoring wild runs of salmon to the Elwha. Furthermore, they sought to achieve this goal in a conventional way – using fish passage. Two separate sets of analyses were instrumental in fundamentally altering the way the agencies thought about the alternatives in this case. The first set of analyses demonstrated what could **not** be achieved through conventional fish passage alternatives. Engineering and cost studies demonstrated the difficulty and cost of successfully passing fish around the dams within the confines of the high canyon walls of the Glines and Elwha dams. Given the physical setting and type of species targeted for restoration, these studies demonstrated that wild runs of the majority of the ten species of salmon could not be achieved. A second set of analyses illustrated the potential for fish restoration without the dams. These analyses included habitat studies that quantified the amount and quality of the habitat above the dams. A study that showed that the degradation of the downstream habitat from dam removal would be limited and temporary was also instrumental in helping convince federal and state agencies that dam removal was not only feasible, but their preferred alternative. Thus, the complete transformation of the attitudes and beliefs for dam removal of the resource agencies (and supporters) was achieved without an environmental valuation.

As the resource agencies and their supporters became increasingly committed to the dam removal option, the case entered the conflict phase. In the late 1980s, the focus of the participants was directed at convincing uncommitted parties, primarily FERC and possibly future courts, of the wisdom of their position. The dominant analytical activity during this phase centered on the technical and cost issues surrounding dam removal. Again, environmental valuation was not used in building the case for dam removal.

As FERC staff were preparing their final EIS and licensing recommendation, Congress intervened and settled the case with the passage of the Elwha River Ecosystem and Fisheries Restoration Act in 1992. The Elwha called for "full restoration of the Elwha River ecosystem and the native anadromous fisheries" and directed the Secretary of the Interior to prepare a report (the "Elwha Report") to evaluate alternatives for fish and ecosystem restoration including a "definite plan for removal" of the dams. Although the Elwha Act never explicitly called for the dams to be removed, the adoption of the language of "full restoration" was pivotal, because it was well established during the conflict phase of the process that dam removal was the only way to achieve full restoration. Congress also removed the liability of removing the dam from James River, agreed to pay the dam owner $29.5 million for the dams themselves and guaranteed replacement power from Bonneville Power Administration. Congress requested no new analysis in reaching its decision.

After the Elwha Act was passed, the case entered the resolution phase. The Elwha report called for in the Elwha Act was produced less than two years later. The report, using essentially the same analyses produced during the FERC proceedings, reaffirmed that dam removal was the preferred alternative for achieving full restoration of the Elwha. While satisfying the requirements of the Elwha Act, the Elwha Report did not satisfy the legal requirements of an EIS under National Environmental Policy Act (NEPA). The Secretary of the Interior determined that two additional analyses would be conducted. The first EIS was to provide yet another analysis of the dam retention versus dam removal alternatives. This report, called the "Programmatic" EIS, would provide yet another analytical justification for dam removal (DOI 1995). The second EIS, called the "Implementation EIS", would identify the preferred dam removal option (DOI 1996). The National Park Service would spend $6.2 million to complete these studies (personal communication, Brian Winter)

In the Programmatic EIS (DOI 1995), the National Park Service and other federal agencies were primarily responsible for the engineering and fish passage studies. The Elwha Tribe, using funds provided by the Park Service, managed the development of the social, cultural, and economic analyses for the EIS. It was in the programmatic EIS that a monetized benefit analysis was included to complement the cost analysis. The benefit analysis included traditional market-oriented benefit estimates associated with improvements in the commercial and recreational salmon fishery. However, the significant costs of dam removal were larger than these direct, readily monetized benefits.

Against this backdrop a contract was made for an ecosystem valuation study (Loomis 1996). That study would insure that the monetized net benefits exceeded removal costs (personal communication, Brian Winter). The contingent valuation study estimated citizen's willingness to pay at the local, state, and national levels to remove the two dams and return the

Elwha River to its natural condition and restore wild salmon runs through dam removal. As stated, people's stated willingness to pay could include both potential future use values (recreational fishing) as well as nonuse or "intrinsic" values associated with a free flowing stream (DOI 1996; Loomis 1996). The study, which was peered reviewed and published in the academic literature, concluded that the monetized benefits of the nation were between $3.47 and $6.275 billion (Loomis 1996).

Why was such an analysis conducted when the decision to remove the dams was already made? Some participants working with the Tribe on the economic portion of the EIS felt that a positive net benefit estimate was important to maintain Congressional support for the project (personal communication, Brian Winter). Although Congress authorized the removal of the dams through the Elwha Act, no funds had been appropriated for actual removal. At the time, there was Congressional pressure to withhold appropriations for the project (Lowry 2003). Other EIS study leaders were not convinced the study was necessary, but in the end, the Tribe elected to fund the study (personal communication, Brian Winter). The EIS study leader stated that this effort was the first large-scale and most expensive EIS most members had ever been involved in, and there was a strong desire to be as comprehensive as possible (personal communication, Brian Winter). The tribe had access to an adequate budget and given the desire to avoid a possible criticism, the decision was made to fund the study.

Did the contingent-valuation study alter the course of the decision? The likely answer seems to be "no". Congress stated that full restoration was the objective and the Elwha Report confirmed removal was the only way to achieve the objective. It is difficult to imagine how the dam removal decision would have been reversed if the EIS produced a benefit cost ratio less than one, but with a qualitative discussion of the benefits and an acknowledgement that some benefits were not monetized. A more plausible argument could be made that a positive net benefit estimate facilitated building Congressional support for funding dam removal. Yet, a positive net benefit result did not appear to spur Congress into action and fully fund dam removal. Congress did not initiate funding for the purchase of the dams until 2001 (personal communication, Brian Winter). Sufficient funds have yet to be appropriated to remove the dams now owned by federal government. To date, the dams remain in place.

Furthermore, the focus of analytical efforts in the resolution phase of the decision centered around the Implementation EIS (DOI 1996). The Implementation EIS focused on identifying the most preferred dam removal option. New technical engineering analysis and modeling of river flows and sediment produced by the Bureau of Reclamation movement resulted in the identification and selection of a new and substantially different approach to dam removal (DOI 1996). Thus, it was these technical analyses that resulted in the most direct and identifiable changes in the behavior and choices during the resolution phase of the decision (Stephenson, Gowan and Shabman, 2005).

Valuation in a Precedent Setting Case: Edwards Dam

While the Elwha case was one of the first cases that required FERC to seriously confront the dam removal alternative, FERC did not itself decide to remove the Elwha dam. The Edwards Dam on the Kennebec River (Maine) was the first, and to date only case, where FERC

ordered the dam removal of an operating hydropower dam against the wishes of the owner (FERC 1997b). The Edwards Dam was the lower most dam on the Kennebec River in Maine. The dam was first constructed in 1837 and was operated by the Edwards Manufacturing Company and the City of Augusta without fish passage (FERC 1997c).

Like the Elwha, the Edwards case centered on fishery enhancement. The Edward dam blocked access to 15 miles of upstream habitat for nine anadromous fish species, including endangered species (shortnose sturgeon) and recreational sport fishes (stripped bass, Atlantic salmon, rainbow smelt) (FERC 1997c). The Edwards, like the Elwha, was a high profile, highly contentious process that drew national and analytical attention (Williams 1993; Harden 1997; American Rivers 1999; Heinz Center 2002).

As typical with a FERC case, the eventual decision to remove the dams was not based on a fully monetized benefit-cost analysis. Rather, FERC assembled and evaluated a number of studies and data including fish passage effectiveness/costs, foregone power costs, and fish habitat studies. As part of this evaluation, FERC's final EIS identified an environmental valuation analysis that quantified the recreational sport fishing preferences on the Kennebec River (FERC 1997c). While FERC cited the study in its analysis, the study was commissioned by an intervener in the case, the Maine Department of Marine Resources. The contingent valuation study conducted by Boyle, Teisl and Moring (1991) asked inland anglers (Maine and out of state holders of fishing licenses) how much they would be willing to pay for the addition of riverine fishing areas and enhanced catch rates for recreational species (Industrial Economics 1998). The survey instrument presented respondents with information about species recovery with installation of fish passage facilities and with dam removal. The study estimated that willingness to pay for dam removal for enhanced sportfishing opportunities was approximately $1.4 million per year (Industrial Economics 1991).

Although the environmental valuation study generated recreational benefit estimates and was cited in the final EIS, the debate surrounding the dam centered on other issues. The other arguments for dam removal were substantial. The rated capacity of the facility was only 3.5 megawatts (FERC 1997c). Furthermore, the replacement power could be provided at about half the cost as generating hydropower (FERC 1997c; Heinz Center 2002). The dam was only profitable for the owner because of a guaranteed wholesale power contract that enabled the owner to sell power at above market rates (FERC 1997c; American Rivers 1999; Williams 1993). The dam removal costs were relatively modest compared to other removals and would cost less than various fish passage alternatives (FERC 1997c; Lowery 2003). Judging from the content of the EIS, however, most of the analysis and debate centered on the biological response and uncertainties of the 9 species to fish passage and dam removal.

Yet, despite this evidence, building the case for dam removal proved difficult because FERC had so little history and precedent for evaluating such a license alternative. In the draft EIS, FERC staff initially recommended fish passage rather than dam removal (FERC 1996). Several commentators attributed FERC's reversal to public hearings that impressed upon FERC staff the depth and breadth of support among the agencies and local citizens for dam removal (Lowry 2003; Heinz Center 2002). In the Final EIS, FERC itself attributed the change in opinion to new biological evidence that indicated the diminished chance of success for passing fish

around the dam and higher habitat value above the dam. In the draft EIS, FERC concluded that all nine species could be effectively be passed around the dams. In the final EIS, FERC concluded no fish passage alternative could successfully pass 4 target species (shortnose sturgeon, Atlantic sturgeon, striped bass, and rainbow smelt), thus failing to meet the stated restoration goals of the state of Maine (FERC 1997c). Furthermore, based on new evidence provided after the draft EIS, FERC also reversed its conclusions about the impact of habitat change with and without the dams on species like smelt and endangered shortnosed sturgeon. For example, originally FERC felt that dam removal would diminish overall sturgeon habitat but in the final EIS concluded that spawning habitat above the dam would increase sturgeon populations by 5000 fish.

While a precedent setting case, the analysis produced in the Edwards case is similar to that produced in most relicensing cases. Substantial resources were devoted to estimating fish response to various license alternatives. Further, economic considerations tended to focus on the costs of fish passage and alternative power costs. Unlike most FERC cases, however, an environmental valuation analysis was specifically requested and funded by a state resource agency. Given the expectation that most studies will be funded by the license applicant, the decision by a state agency to fund a study indicates that the study and results was considered important at the time. Examining the record of decision, however, the study seems to be part of a broad and concerted effort to build broad general support the dam removal option, but was not used in a formal way to evaluate the benefits and costs of the alternatives.

Interpretation of the Role of Environmental Valuation at FERC

Some economists have been critical of FERC suggesting that because environmental valuation calculations are not being used, the legislatively required balancing under the FPA cannot be accomplished. John Loomis and Marvin Feldman state "… being able to quantify most of the affected benefits and costs on a comparable basis would contribute to ensuring that nonpower resources really are given equal consideration in FERC licensing and relicensing decisions (1995, 97)."

As a factual matter this review also finds that environmental valuation is not used as a guide for FERC commissioner decision making. What we observed is that when the alternative processes were put in place and the opportunity to rely on environmental valuation studies was present, none of the cases examined found evidence that valuation studies were used to inform the decision process. In the high profile dam removal cases valuation of some environmental services was conducted, but we conclude either EV studies legitimized prior decisions or played a minor role in the final decision.

FERC has not responded to pressure to place more weight on environmental services by adopting analytical approaches to monetize the value of all ecosystem services. Instead, FERC compares dollar estimates of the costs of mitigation options (construction plus foregone power costs) with predicted biological and physical changes in ecosystem function. The general analytical process FERC applies is familiar to the Corps - cost effectiveness/ incremental cost

analysis. Participants in the FERC licensing process use a version of a CE/IC framework as a way to organize stakeholder conversations and not as a decision making calculation.

However, because full valuation is not done it does not follow that environmental values are ignored. We instead find highly organized and structured processes for considering environmental and other values associated with dam relicensing. FERC relied on more inclusive and collaborative processes to make the necessary trade-offs involving environmental services rather than require new analytical methods. The decision participants in these collaborative processes, in turn, have used the responsibility weigh the environmental gains against the reported costs of mitigation and make judgments as to the environmental worth of a mitigation option without the aid of environmental valuation.

Public statements of support for the new licensing processes from a diverse set of groups, including the hydropower industry, environmental groups, and resource agencies (Groves and Liimatainen 1999, Keil 2002, Wilson 2000, Richter et al. 2003) affirm this conclusion. Such statements of support are additional evidence that participants are willing and able to consider non monetized watershed services against monetized services that have closer market analogues in making a decision.

Implications for Environmental Valuation in Corps Planning and Decision Making

FERC decision making on dam operations came under increasing scrutiny and criticism and the licensing process became more costly and contentious as result (Stephenson, 2000). The Corps has had a similar experience in recent years as it proposed new projects and considered re-operation or decommissioning (akin to dam removal) of existing projects. In the regulatory program the Corps has found itself embroiled in controversies over applications for permits for large water supply facilities where multiple environmental impacts were identified and had to be weighed against the need for additional reliable water supply for cities (Shabman and Cox, 2004) Some have encouraged the Corps to extend its NED analysis to calculate the money value of a fuller range of environmental services to address such controversies, just as they have encouraged the FERC to pursue such analyses. FERC has chosen collaboration over calculation. What lessons from the FERC experience for the use of monetization and for collaborative decision making can be of interest and value to the Corps?

In answering this question, we recognize that the Corps responsibilities for preparing recommendations for major federal investments, for developing and revising the operations plans for past investments and for reviewing and issuing permits for placement of fill material in waters of the United States (the regulatory program) differ in several ways. Each of these responsibilities carries with it its own particular analytical, reporting and decision making rules, based on how the organic legislation governing the program is interpreted by administrative rules and through court rulings. Each of these responsibilities engages a different mix of stakeholders in its execution. And, each of these responsibilities is executed for particular actives in particular places. We also recognize the differences between the FERC context and any of these Corps responsibilities. As one example, in the FERC licensing process (a form of permitting) stakeholders who can veto any proposed plan are formally identified, enter into the decision

process in the early stages and are given standing in the process to help shape the decision. In the Corps fill permitting process stakeholders are rarely engaged initially, few are formally recognized as having decision powers (EPA has a rarely used veto authority) and the permit review process is organized around comments submitted to the Corps on the permit application and draft decision documents rather than a shared discussion among stakeholders.

For the planning program, and perhaps to some extent for the development of operational rules the Corps has issued new guidelines for collaborative planning (http://www.usace.army.mil/publications/eng-circulars/ec1105-2-409/toc.htm). For these responsibilities, as well as in the regulatory context, the Institute for Water Resources has promoted and at times applied the concept of shared vision planning (http://www.iwr.usace.army.mil/iwr/svp/home.htm). In the discussion that follows we offer findings and recommendations that are general enough to apply to any of these decision making responsibilities.

Any Corps efforts to monetize the positive and negative effects on environmental services in watersheds as part of a restoration analysis should first establish that the relevant stakeholders and decision makers will accept environmental valuation estimates and use such estimates as decision making information.

In the early years the FERC mandate was expanded to include considering the effects of power development on other services. This expansion coincided with the shift in the 1940s and 1950s from single to multipurpose water development planning. Note however, that the presumption was that water development projects that controlled the hydrologic regimes of river systems were essential to the national welfare. The more recent shift, and one that is not widely recognized, has been a change in the rebuttable presumption favoring water control projects and their operations. In the past the project were expected to maximize water control for promoting the production input services, as long as there were acceptable “environmental consequences”. Now the decision question is framed in the opposite way - we should maximize the restoration of pre-dam river flows unless the costs of doing so are deemed unacceptable. This is why dam removal has now become a legitimate alternative within the relicensing process.

The Corps has embarked on a new mission termed national environmental restoration (NER). NER for the Corps should mean, as it has come to mean for FERC, the reintroduction of more natural hydrologic and geomorphic processes in watersheds that have been altered by water control structures (NRC, New Opportunity, 2004). As incremental increases in restoration levels are considered, these increases may come at increased costs in terms of financial outlays and forgone benefits from the existing water control system. The question is whether monetary valuation can be useful information for the Corps when answering the question of how much and what kind of restoration is warranted.

There is very little evidence from the FERC experience that public policy participants use monetization of nature’s services to make tradeoffs and choices in either precedent-setting or ordinary hydropower-relicensing cases. Recall that “use” can mean adding environmental valuation to the NED (benefit cost) calculation for making a determination of the socially

preferred tradeoffs. This is a use that FERC processes have not accepted and one that can be professionally and politically controversial. Some of those involved in the FERC processes suggested in comments to the authors of this report that valuation studies were highly controversial and debates over the validity of the studies would supplant the needed debates over the decisions that need to be made.

The argument is often made that EV is simply additional information that is brought to bear in the decision process. In this case, use also could mean that environmental valuation estimates are introduced by one or more decision participants to advance the arguments they are making as part of the policy conversation. In this use environmental valuation is employed to persuade others (stakeholders and budget authorities) about the incremental justification for one alternative over another. There is no evidence that FERC processes use environmental valuation in this way. Whether the instrumental value in the policy conversation of valuation justifies the cost of the analysis is situation specific.

Finally, use can mean offering environmental valuation as legitimation for decisions made on other grounds. In this use the environmental valuation estimates may be made part of a reported net benefits analysis. However, to suggest to budget or other decision authorities that the decision is justified by such a calculation (if the analysis did not provide such justification it would not be reported) is disingenuous at best. Such after-the-fact calculations might be reported as a part of an overall statement of justification to help secure budget or other support. This was the use made of environmental valuation in the Elwha case. The decision over whether to invest in valuation studies for this purpose rests on a consideration of the need for such legitimation.

Comprehensive and sound technical analysis, other than monetization of all watershed services, is essential to collaborative environmental decision making.

The FERC experience highlights the central role of technical analysis in facilitating the preference discovery and creation process. Participants in collaborative decision processes rely on cost, hydrologic, and biological-response analysis. Four lessons for the Corps are suggested by the type and quality of technical analysis done in the FERC cases.

First, indicators of change for the environmental services differ among the cases in consideration of the watershed situation and the participating stakeholders. To be useful in a collaborative process, indicators must also be understandable and meaningful to decision participants. To a certain extent, indicators must to some extent emerge from a collaborative process and cannot always be defined in advance or in isolation. The FERC experiences used metrics as “environmental performance indicators” that ranged from structure (number of acres) to function (river hydrology) to services (recreation days). The Corps has relied on composite indices (e.g. habitat units) as a representation for environmental outcomes. Habitat units may not have an intuitive logic to many stakeholders and if this is the case, the Corps may want to consider more direct metrics to measure structure, function or services.

Second, the analysis in support of preference discovery should confront the participants with costs of making alternative choices. Costs may be measures of forgone output (such as lost

generating capacity or reduced flexibility to meet peak demands) and no monetization of these effects may be made. In other cases there may be attempts to put a monetary value of some of the costs (forgone NED benefits in the Corps planning terminology). Because of the tradition of doing such NED analysis it is likely that the Corps will continue to monetize some effects of any alternative. For those effects that are monetized (positive and negative) the cost measures could be aggregated to yield a net cost for comparison with incremental changes in the environmental performance indicators. The current Corps practice on doing IC/CE analysis on only financial expenditures on the project may provide less than adequate information for the preference revelation process.

Third, FERC's cost analysis tends to be based on engineering models to calculate the cost of replacement power generation, but more refined cost analysis could more closely approximate willingness to pay measures for benefits and costs for service changes. The Corps should assure that in its economic analysis that opportunity costs are accurately assessed and include more than financial outlays. Economists will be sensitive to the market adjustments that will occur. To illustrate with a power example, if a flow restoration alternative curtails power-generating capacity, changes will be made within the power generation firms, in power marketing and on the demand side, which will minimize (not eliminate) the cost of replacement power. In fact, in a deregulated electricity market it may be that operating rules certainty (reliability and flexibility to benefit from price fluctuations) to allow load following has a value to projects owners that is not possible to calculate by just estimating the cost of generating replacement power for the current generation system.

Fourth, in the FERC process analysts also often are facilitators who have a mind set of expanding the gains from agreement to all parties, by framing and helping to analyze complex tradeoffs in terms agreeable to participants. In some instances there is a separation where the analysts contribute to the collaboration, but the process is managed by specialized facilitators. In either case for the Corps to be successful in its collaboration efforts, its analysts skills should include not only a working technical knowledge of disparate fields of expertise, but also group facilitation skills that include the ability to probe assumptions, keep many threads of argument in hand, and to communicate effectively. These are learned skills, often acquired by practice. The Corps needs to develop training opportunities and opportunities to gain experience in leading such efforts within the framework of its shared vision planning program. As noted by Majone (1992, page 9)

> "… persuasion is a two way interchange, a method of mutual learning through discourse. Real debate not only lets the participants promote their own views and interests, but also encourages them to adjust their views of reality and even to change their values in the process. … Fashioning mutual understanding of the boundaries of the possible in public policy is arguably the most important contribution that analysts can make to public debate."

<u>The design of the collaboration process is central to its efficiency and to its acceptability to stakeholders and the public.</u>

The FERC licensee now has the option of the "alternative" and "integrated" licensing processes, rather than the conventional FERC licensing process (Swiger and Grant 2004). The participants in these collaborations must develop common understandings about what is at stake, what issues are most important to them and which ones they are willing to negotiate in order to reach an agreement. In turn, the processes must yield recommendations that the FERC commissioners can review, endorse and then implement, while exercising the congressionally mandated mission contained in the FERC organic legislation. There are several design features of the alternative/integrated licensing processes that offer lessons for the Corps.

First, if beneficiaries do not bear the costs of the decisions they seek to influence, the potential for cost shifting to others will make the outcomes optimal for the parties to the negotiation but come at a cost to the society at large. In the FERC processes the costs of restoration fall on one of the decision participants who must agree to the license condition - the dam owner. In the Corps setting there are opportunities to shift costs to the federal treasury, so it will be the job of the Corps analysts to represent the "federal taxpayers" interests. Preferably, cost sharing reforms will be made to foster more attention to costs on the part of the decision participants.

Second, in the FERC process participants often reach compensation agreements so that all decision participants deem themselves better off with the agreement that is made. For instance, a recreational fishing group may accept a series of recreational enhancements (boat landings, access points, etc) as compensation for enhanced load following flexibility that would alter downstream flow.[11] For the Corps, the agency may want to increase attention to offsetting of documented costs - economic mitigation. Without economic mitigation, agreements may not be possible. In the Corps planning context, plans to do such things as modify the hydrologic regime, reduce commercial oyster harvest, or control logging to increase fish runs might be accompanied by compensation for lost income to commercial fishermen, to forest products firms, and to irrigators. Analysis to identify appropriate compensation levels should accompany other analyses.

Third, the process must strive to represent the most affected stakeholders. This argument for representation is in fact one that is made to support environmental valuation.

> "Valuation studies can make possible a "dollar democracy" in which every citizen's voice is heard through their benefits and costs, regardless of how small they are per person. Without valuation studies, only those with sufficiently concentrated costs and benefits to attend hearings, committee meetings or make large campaign contributions will be heard. Valuation studies have the potential to provide an effective way to diminish the often bemoaned role of "special interests" in the current policy process. For this reason alone, valuation studies are tremendously valuable." (Loomis, 1997. 8)."

[11] However, FERC is increasingly seeking to assure that compensation has a strong nexus to the documented costs being imposed on one of the participants and is not used to secure agreement from those who might threaten to block an agreement.

The FERC process accepts the need for representation, but does not see the role of valuation as the means to assure this presentation. Instead, the FERC establishes a process to ensure representation for public trust resources and encourages the participation of other affected or interested in the licensing process. The licensing process ensures that the public interest in fish and trustee resources is represented by specific federal and state agencies with that mission. The licensee must recognize and involve other interested parties with an interest in the project as well. As the Corps moves forward there must be a recognition of the increasing decision making costs (decision making delays and financial costs) as group numbers increase. Also there is a decreased likelihood of reaching agreement as group size increases. However, if an excluded group can influence the decision outcome outside of the process, then that group's exclusion may help achieve consensus on a preferred alternative, but the excluded group may be able to block implementation of the preferred alternative (for example by legal action). The public choice literature in economics, as well as the literature on environmental negotiation and alternative dispute resolution, includes numerous studies and recommendations about how this dilemma might be addressed through different forms of group decision rules, through the different roles that might be played by the convener of the negotiation (facilitation, mediation and arbitration), through the legislative actions to constrain the opportunities for opposition and through different rules for the distribution of project costs. The Corps could initiate a research study that applies these basic principles to establish guidelines for field units for developing representative groups for collaborative decision making processes.

Fourth, the collaboration process needs to begin early and all stakeholders as well as agency representatives need to be fully engaged at the outset, if the preference discovery results are to be achieved. To the advocate for environmental benefits calculation, preferences are brought wholly formed to each decision and only need to be measured in money terms. However, the alternative view is that preferences are modified and discovered in market exchange and this same logic applies in public discourse. "Preferences are not encoded in human DNA. Rather, preferences are developed or discovered as one goes about choosing." (Vatn and Bromley 1994, 4).

With this perspective an effective collaboration process is one that provides a forum for debating and forming preferences. Majone reminds us that "… democracy has been called a system of government by discussion." Lindbloom emphasizes the extraordinary potential of persuasion and the centrality of the two-way discussion to policy making in a democracy. In this setting a continuing conversation is how preferences come to be discovered (indeed created). Sagoff summarizes this view as follows: "Like actual markets, democracy does not take preferences as they come but alters them; for example, it subjects them to public scrutiny and debate… The values emerging from democratic decision making are supposed to differ from those entering it; the capacity of political debate to transform views even lends legitimacy to the political process." (Sagoff 1994, 136). It is for this reason that any collaborative process, as illustrated by the FERC processes, must be initiated early and include the full suite of stakeholders and agencies with decision authority.

Discussion and Conclusions

Decisions made in the Corps, as in the FERC, and about the mix of services from a watershed (natural capital) can be made through negotiation among affected interests. The analyst's task is to help the participants in the decision process discover and reveal their preferences for different watershed services by exploring their willingness to incur costs to satisfy those preferences. A properly executed CE/ IC analysis can serve this environmental value discovery process. In fact, the Corps has already demonstrated its authority to do such analysis and its ability to find solutions in this way. See for example, http://www.matilijadam.org/

A helpful economic analysis will illuminate the incremental opportunity costs of seeking different levels of an environmental metric, but may not seek to value the environmental services in money terms. From a current watershed condition analysts describe the full opportunity cost of seeking alternative levels, scales and locations of the environmental metrics. Opportunity costs include: 1) direct life-cycle financial outlays by government and individuals, and 2) existing power, irrigation, flood risk, and other production input and water supply services that would be reduced or lost. By focusing collaborators attention on whether a proposed restoration action is worth its opportunity cost, restoration "benefits" are discovered and established by the decision process. There may be a role for environmental valuation estimates in this discovery process, but the costs of doing environmental valuation analysis must be weighed against the likelihood it will have instrumental value for that purpose.

Collaborative and shared decision making is a new, but not unfamiliar, endeavor for the Corps. Over time there will need to be procedural guidelines and training for Corps staff. Corps planners will face new and exciting challenges as they pay increased attention to the best ways to structure and then facilitate negotiation processes, while also serving as one of the technical experts. The experimentation of the Corps with Shared Vision Planning is a positive step toward exploring how these twin roles can be served, but meeting the challenge will require a new skill set for Corps planners (http://www.iwr.usace.army.mil/iwr/svp/home.htm)

Finally, for regulatory and for making budget recommendations to the Administration and the Congress reliance on a collaborative processes does not mean that the agency must concede its congressional decision making authority to others. It is the case that if all interested parties to the negotiation can agree on a mutually satisfactory license, FERC will be inclined to write these conditions into the license (Stephenson 2000). Thus, the FERC alternative processes appears to downplay the role of FERC commissioners in deciding the appropriate balance between power benefits, dam rehabilitation costs and environmental services. That would be a misinterpretation of the process. Instead, the FERC relies on these processes to elicit values and define acceptable tradeoffs. In that sense the processes are substitutes for the calculations being called for by the advocates of environmental valuation and the use benefit cost analysis. However, in the end the commissioners still must test the resulting agreement against their own congressional mandates to assure that they are executing their responsibility to the public interest.

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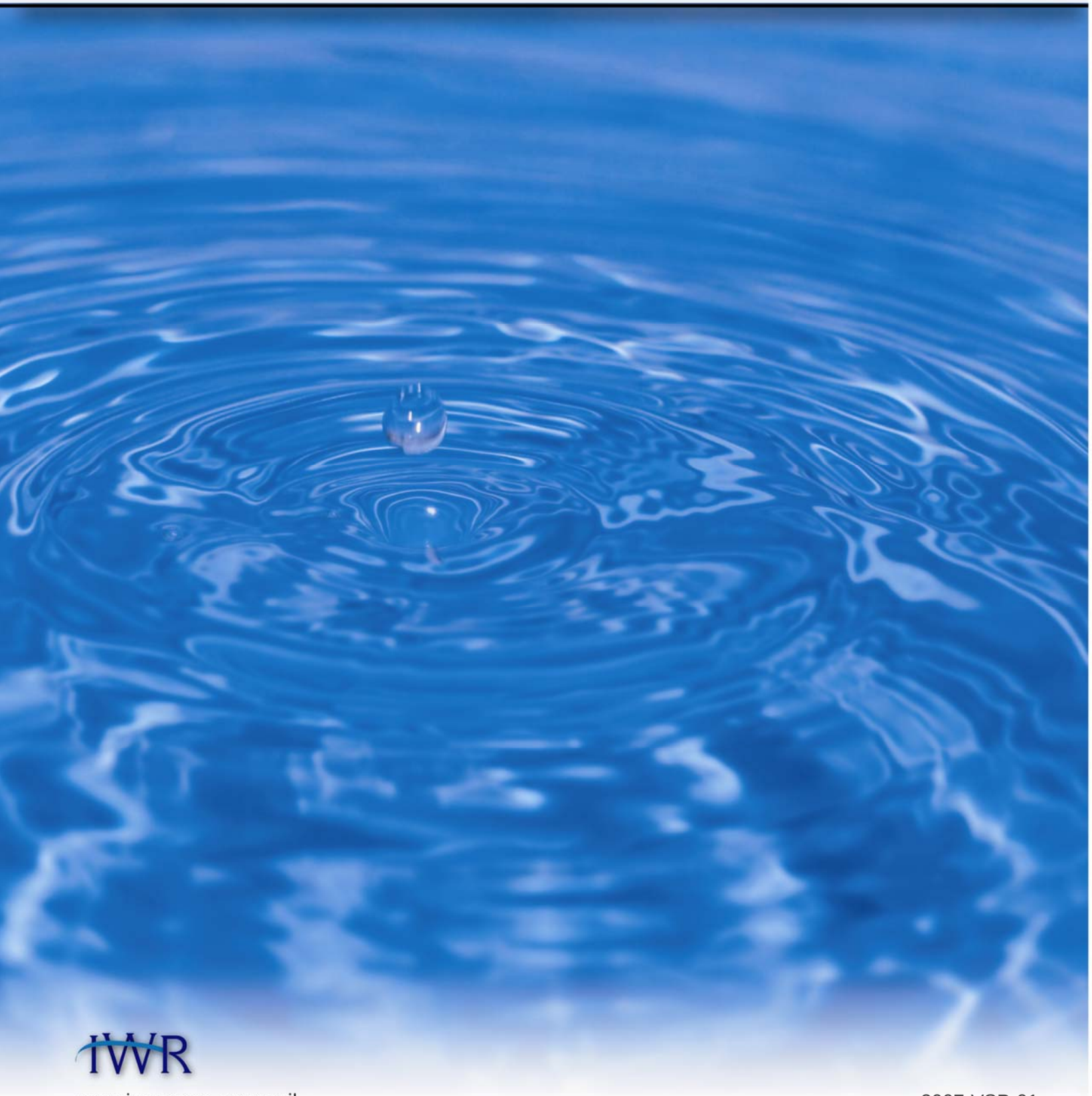

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